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SPECIAL ISSUE

MULTIENERGY SYSTEMS

Edited by M. Chertkov and G. Andersson

1392 Integrated Electricity–Heat–Gas Systems: Techno–Economic Modeling, Optimization, and Application to Multienergy Districts
By E. A. Martínez Ceseña, E. Loukarakis, N. Good, and P. Mancarella
|INVITED PAPER| This article is a tutorial on modeling and simulations of a multienergy system containing a portfolio of integrated electricity and gas distribution and district heating subsystems.

1411 Multienergy Networks Analytics: Standardized Modeling, Optimization, and Low Carbon Analysis
By W. Huang, N. Zhang, Y. Cheng, J. Yang, Y. Wang, and C. Kang
|INVITED PAPER| This article gives a review of standardized modeling and analysis of multienergy networks from the perspective of planning and operation, especially under low carbon circumstances.

1437 Multicarrier Energy Systems: Shaping Our Energy Future
By M. J. O'Malley, M. B. Anwar, S. Heinen, T. Kober, J. McCalley, M. McPherson, M. Muratori, A. Orths, M. Ruth, T. J. Schmidt, and A. Tuohy
|INVITED PAPER| This article provides a review of multienergy systems in the context of future low carbon energy systems based on electrification and very high variable renewable energy penetrations.

1457 A Hierarchical Approach to Multienergy Demand Response: From Electricity to Multienergy Applications
By A. Hassan, S. Acharya, M. Chertkov, D. Deka, and Y. Dvorkin
|INVITED PAPER| This article describes a modeling framework based on Markov decision processes to parameterize and model multienergy dynamics in dispatch tools.

1475 Optimal Capacity Design and Operation of Energy Hub Systems
By S. Geng, M. Vrakopoulou, and I. A. Hiskens
|INVITED PAPER| This article poses and describes an algorithmic solution for day ahead scheduling of energy resources with uncertainty resolving recourse.

1496 Flexibility From Distributed Multienergy Systems
By G. Chicco, S. Riaz, A. Mazza, and P. Mancarella
|INVITED PAPER| This article presents a comprehensive overview for distributed multienergy modeling and characterization for flexibility applications.

1518 An Uncertainty Management Framework for Integrated Gas-Electric Energy Systems
By L. A. Roald, K. Sundar, A. Zlotnik, S. Misra, and G. Andersson
|INVITED PAPER| This article offers a modern optimization perspective on the benefits of co-optimizing gas and electricity network operations in systems with a comparable penetration of renewables and gas-fired power plants.

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DEPARTMENTS

1387 SCANNING THE ISSUE
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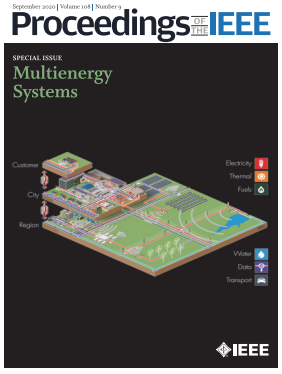

On the Cover:
Our cover image this month highlights the concept of energy system integration which is required for creating flexible energy systems to meet global imperatives while also maintaining reliability and competitiveness. Reprinted with permission from "Energy Systems Integration: Defining and Describing the Value Proposition" by O'Malley *et al.*

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1541 Operations and Long-Term Expansion Planning of Natural-Gas and Power Systems: A Market Perspective
By A. J. Conejo, S. Chen, and G. E. Constante
|INVITED PAPER| This article discusses history and optimization approaches to long-term planning of interdependent but independently operated natural-gas and power systems.

1558 Monotonicity Properties of Physical Network Flows and Application to Robust Optimal Allocation
By S. Misra, M. Vuffray, and A. Zlotnik
|INVITED PAPER| This article demonstrates how multienergy systems have triggered fundamental research regarding flows of commodities in general networks.

1580 Modeling and Simulation of Gas Distribution Networks in a Multienergy System Environment
By A. J. Osiadacz and M. Chaczykowski
|CONTRIBUTED PAPER| This article explains new challenges in modeling and operations of the gas distribution systems associated with increased opportunities in gas-to-power activities at the distribution level.

1596 Smarter Smart District Heating
By N. N. Novitsky, Z. I. Shalaginova, A. A. Alekseev, V. V. Tokarev, O. A. Grebneva, A. V. Lutsenko, O. V. Vanteeva, E. A. Mikhailovsky, R. Pop, P. Vorobev, and M. Chertkov
|INVITED PAPER| This article reviews modern district heating systems, with the main emphasis on the new challenges in modeling, operation, and planning.

1612 Optimal Configuration of Power-to-Cool Technology in District Cooling Systems
By E. Guelpa, L. Bellando, A. Giordano, and V. Verda
|INVITED PAPER| This article reports studies on new opportunities in power-to-heat technology, taking advantage of the incidental access and unbalances of electricity due to integration of renewables.

1623 A Critical Exploration of the Efficiency Impacts of Demand Response From HVAC in Commercial Buildings
By J. S. MacDonald, E. Vrettos, and D. S. Callaway
|INVITED PAPER| This article is devoted to the data-driven analysis of utilization of the demand response resources at the distribution level.

1640 Chance-Constrained Water Pumping to Manage Water and Power Demand Uncertainty in Distribution Networks
By A. Stuhlmacher and J. L. Mathieu
|INVITED PAPER| This article demonstrates how water pumping in drinking water distribution networks can be treated as a flexible load in the power distribution network.

1656 Recent Developments in Machine Learning for Energy Systems Reliability Management
By L. Duchesne, E. Karangelos, and L. Wehenkel
|INVITED PAPER| This article reviews opportunities and challenges in adapting and developing machine learning methodology and tools for studies in bulk power systems as well as in other distribution, microgrids, and multienergy systems.

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